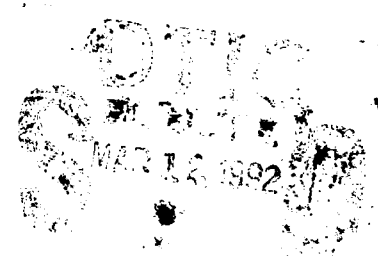# NAVAL POSTGRADUATE SCHOOL
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College Resources and the Performance of Black Naval Officers
by
Joseph E. Hines and Samuel C. Howard
JUNE 1991
Thesis Advisor: Stephen Mehay Co-Advisor: Mark J. Eitelberg

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College Resources and the Performance of Black Naval Officers

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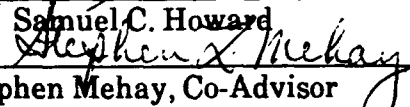
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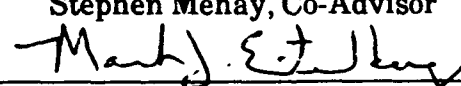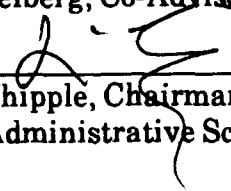NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

The purpose of this thesis was to examine the effect of college resources and attendance at a Historically Black College or University (HBCU) on the performance of Black Naval officers. The effects of college resources, college attendance, and other factors on officer performance measures were evaluated using multivariate logistic regression analysis techniques. The results of the analysis show that college resources have significant and positive effects on the probability of promotion for Black officers commissioned through the Navy Reserve Officer Training Corps or Officer Candidate School. Attending an HBCU had a negative effect on receiving the RAP mark on LT fitness reports and a positive effect on retention.

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I. INTRODUCTION

A. OVERVIEW

Today's military is richly composed of many racial and ethnic groups. Of particular note is the strong involvement of black Americans within the enlisted ranks. On the officer side, black representation in the Army officer Corps is high. However, the Navy trails at a significant distance in terms of its percentage of black officers. For decades, Reserve Officer Training Corps (ROTC) units at historically black colleges and universities (HBCU) have been the principal source of black officer accessions for the armed forces, particularly in the Army, where units have existed for nearly fifty years. This is true primarily because it has only been a relatively recent innovation for white colleges to enroll blacks in large numbers [Ref. 1].

Many argue that the education offered at HBCUs is of a lesser quality than that offered at non-black colleges. The merit of this notion can be supported or refuted from several angles; therefore, the complete resolution of the issue will be excluded from the scope of this study. However, the statement can be made confidently that HBCUs are, on the

average, less "competitive"[1] than predominantly White colleges. While several reasons for this exist, one that can be substantiated in several ways is that most black colleges have fewer financial resources and physical facilities to devote to student education than non-black institutions [Ref. 2]. Because an abundant resource base at a college attracts students, who are seen as generators of tuition revenue and research revenue, those schools that have higher funding levels and endowments tend to rise in prestige. As an institution's reputation is eclipsed, its ability to provide the highest quality of education is also hampered. This argument assumes that the human capital theory applies to the resources that a school has available, which allow for greater returns to the investments that students make.

If the human capital assumption is plausible, it could be concluded that individuals commissioned into the Navy at HBCUs will have a lower quality education and may, therefore, exhibit lower performance levels as officers. A casual assumption would be that the Navy could find savings in fiscally austere times by disbanding or reducing accessions from Naval Reserve Officer Training Corps (NROTC) units at HBCUs. Under this assumption, such a policy would help to

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[1]Here the term refers to the ratio of the number of students accepted for enrollment compared to the number that apply.

ease budgeting constraints and reduce total accessions as mandated by Congress. [Ref. 3]

However, acting on this assumption could have several, mostly undesirable, results and lead to the problems that this study addresses. First, at a time when HBCUs are not receiving the levels of funding they need to maintain their position, it might possibly be more difficult for these schools to get their fair share of the available financial bounty by casting doubt on their academic reputations. Second, removing the units would very likely have an adverse effect on the image of the Navy in black society. Lastly, removing the NROTC units will ultimately impact negatively on reaching the Navy's goal of six percent black officer representation by the end of the 1990s. [Ref. 4]

B. AREA OF RESEARCH

This thesis addresses differences in the output of the NROTC units. It focuses on differences in performance of black officers commissioned at units hosted by HBCUs as compared to black officers commissioned from NROTC at non-black institutions. Performance of officers is assessed using different measures of success in the Navy such as selection for command, recommendation for early promotion to the next higher rank, and actual promotion.

The primary issue examined here is whether the differences in the amount of resources available to institutions

correlates somehow with the performance of black naval officers who have graduated from these institutions. The authors believe that institutional resources have a primary effect on cognitive development. Hence, we hypothesize that institutions with more resources per student will produce officers who are likely to perform better than officers from schools with fewer resources. The methodology adopted attempts to isolate the influence of this factor on officer performance.

1. Discussion

The Navy currently maintains 66 NROTC units at some of the most reputable colleges and universities in the country. Most of the host schools are large and well-endowed. Six units are located at the following HBCUs: Morehouse College, Southern University, Prairie View A & M University, Savannah State College, Florida A & M University, and within the Hampton Roads consortium, Hampton University, and Norfolk State College. Together, the NROTC program supplies approximately 25 percent of all new officer accessions, with the U.S. Naval Academy and the Officer Candidate School at Newport, Rhode Island providing the balance (minus staff corps and limited duty direct commission officers). Of these new officers, the Chief of Naval Operations (CNO) has tasked the Chief of Naval Personnel (CNP) with ensuring that each of these sources commission at least seven percent black officers

per year for the Navy to attain its goal of six percent black officer representation by the year 2000. [Ref. 4:p.10]

With Congressionally-mandated reductions in force size and significant cuts in the defense budget now taking place, it is becoming necessary to closely examine all of the Navy's officer accession programs to ensure that they are producing the highest quality officers possible. Prior studies have indicated that the education offered at HBCUs is of a lesser quality than that offered at non-black colleges, suggesting that individuals commissioned at HBCUs will have a lower quality education and thus have lower performance levels as officers.

2. Scope of the study

Using the methodology discussed below, this study examines the success of Naval officers who graduated from NROTC units at HBCUs as compared to black officers who were commissioned through NROTC programs at other colleges. While examining issues of quality in the host universities, this thesis also examines current policies regarding the placement and staffing of NROTC units. The effects of these policies, in view of the Navy's Affirmative Action Plan, are also discussed.

3. Methodology

The objective of this study is to look for differences in the performance of Naval officers commissioned at HBCU

NROTC units as compared with those commissioned at other institutions using human capital theory. Two data sets are employed. One data set is from the National Center for Education Statistics and contains resource data on various colleges and universities, including all 66 of the NROTC schools. The other data set, provided by the Navy Personnel Research and Development Center (NPRDC), includes commissioning source, fitness report information, and other personal and demographic data on nearly two thousand black naval officers. Using these data, a "logit" model is constructed that controls for differences in resources, graduation from an HBCU, and other personal attributes. The dependent variable adopted is promotion to the next higher grade. The multivariate "logit" model permits the independent effects of numerous factors on officer performance to be isolated and measured. In this way, we can determine the contribution of college resources versus other characteristics of the individual officers.

C. **ORGANIZATION OF THE STUDY**

Chapter I provides an overview of this study.

Chapter II is a condensed history of black participation in the Armed Forces leading to the commissioning of the first black officers in 1944. It includes a history of the NROTC program and black participation from 1944 to the present.

Chapter III is a review of the literature pertinent to the development of the model that has been constructed for this thesis.

Chapter IV provides a detailed description of the data and research methodology used. Construction of the data sets is discussed along with model design.

Chapter V presents the analysis and a summary of the results.

Chapter VI offers several conclusions and recommendations based on the analysis.

II. HISTORY AND BACKGROUND

A. EARLY BLACK MILITARY INVOLVEMENT

1. The Revolutionary Period

Participation of blacks in the armed forces of the United States is rooted in the origins of our nation's independence. Since the settling of this country, African Americans have always stepped forward in times of crisis and fought for the right to defend it. At most every junction in history, when society had doubts about the desire or ability of blacks to contribute, and constructed barriers to their opportunity to do so, the military offered the chance for them to serve and display great courage, leadership, and gallantry. Crispus Attucks, a black man, became the first fallen American of the Revolution as a participant in what was to become the Boston Massacre. The War of 1812, which was primarily a naval war, saw the U.S. rely heavily on black seaman to staff ships. In fact, about one-sixth of all volunteer naval personnel at the time were black, and they worked in all ship ratings without regard to their color [Ref. 5]. blacks were, however, barred by regulation from serving in the Army components during the war [Ref. 6]. The general sentiment of senior officers toward blacks in naval service

was positive, as noted in a letter written to Oliver Hazard Perry by his superior, Captain Isaac Chauncey:

> I have yet to learn that the color of the skin, or the cut and trimmings of the coat, can affect a man's qualification or usefulness. I have nearly fifty blacks aboard this ship, and many of them are among my best men. . . . [Ref. 5:p. 3]

2. Civil War Era

Black military involvement in the "War Between the States" was significant. Government policy in 1861 excluded blacks from serving in an armed capacity; however, several ranking civil and military leaders accepted them as a valuable source of manpower [Ref. 7]. Within a year of the issuance of the Emancipation Proclamation, nearly 100,000 former slaves filled the ranks of the Union militia. In fact, General Grant wrote to President Lincoln in 1963:

> By arming the Negro we have added a powerful ally. They make good fighters, and taking them from the enemy weakens him in the same proportion they strengthen us. I am most decidedly in favor of pushing this policy to the enlistment of a force sufficient to hold all the South falling into our hands and to aid in capturing more. [Ref. 5:p.5]

The Union and Confederate Navies made use of blacks from the beginning of the War. They served in integrated ships and units, unlike black Army soldiers who served only in segregated units. None were appointed as officers or petty officers. However, one former slave, Robert Smalls, was given command of a ship named the *Planter* by the Union. Smalls, a slave-pilot, commandeered the ship away from the Confederates

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at Charleston Harbor and sailed it into Union hands in May, 1862. After being granted his freedom, he served as a Union Navy coastal pilot before returning to the *Planter* as its captain for the duration of the War [Ref.6:p.23]. Smalls, like all other blacks, was not commissioned in the Navy but rather as an officer of volunteers in the Army. The Navy would not promote him as a matter of policy because "he lacked appropriate training at either the Naval Academy or a school for volunteer officers." [Ref. 7:p.81]

3. Reconstruction to the End of the Century

The post-Civil War era saw continued service by blacks throughout the Armed Forces. Many were promoted to senior enlisted ranks, although no black officer was appointed in the regular Army[2] until 1877. Henry Ossian Flipper became the first black graduate of the U.S. Military Academy at West Point in the spring of that year. He served with the Western black regiments until 1881 [Ref.6:p.27].

There were 22 blacks serving in all ratings among those killed aboard the *USS Maine* at the start of the Spanish-American War. The survivors and other sailors of color served, along with thousands of black Army troops, for the entire war.

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[2]Several Blacks were commissioned in the Army Reserve and National Guard.

The Navy continued to enlist and even promote personnel without a real regard for skin color. Blacks were "always entered on the books without any distinction...," giving evidence that Jim Crow practices were not a part of Navy assignment policies [Ref.5:p.1]. This rather progressive policy of integration was maintained by the Navy until the years just prior to World War I.

B. TWENTIETH CENTURY CHANGES IN BLACK MILITARY PARTICIPATION

Throughout the previous decades, opportunity for blacks to advance in the military grew in many ways, but it was also withdrawn in many others. The number of Army Colored troop units increased, as did the number of commissioned black Army officers, even though they only led segregated units in the military as a standard policy. Societal influences had an adverse effect on those who chose to serve at sea.

1. Withdrawn Opportunity

The U.S. involvement in the First World War came at a time when social pressures were mounting between the races. The Navy began a benign practice of limiting black access to skilled and general service ratings. Those who were accepted served as coal-passers below decks or as messmen. The conversion to oil-fired boilers further restricted opportunities for blacks [Ref. 8]. The Navy saw only 6,750 blacks serve in World War I, only about one percent of its total force [Ref. 9].

Following the war, as the Navy demobilized, most blacks were denied the chance to reenlist. As manpower needs increased in the early 1920s, blacks were overshadowed by Filipino recruits as the preferred mess specialists. This continued for approximately ten years until the steward rating was reopened to blacks. The few colored sailors that held combat-related ratings were not hindered in their attempts to ship over, and many continued to serve through the 1930s. [Ref.8:p.5]

By 1942, U.S. involvement in World War Two (WWII) virtually forced the Navy to extend enlistment opportunities for blacks to serve in jobs beyond steward. This change was primarily the result of negative publicity the Navy received in the black press [Ref.8:p.66]. In June 1942, an isolated section of the Great Lakes Training Center was renamed Camp Robert Smalls. This became the recruit training depot for all black sailors. While blacks could now serve in a multitude of skilled ratings, they were forced to do so in a newly segregated Navy.

By 1943, over 100,000 black sailors populated the Navy. Most were assigned to all-black units at shore stations and ammunition depots, with many serving in all-black SeaBee battalions overseas. The only afloat billets open to colored sailors were as stewards, described by the black press as "seagoing bellhops." [Ref.8:p.59] Because of their rather short time in service, no blacks rose to senior leadership.

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A perception of non-opportunity began to gain momentum among blacks in the Navy and in the civil rights organizations.

2. Opportunity Restored

The Special Programs Unit was formed in 1943 to help find solutions to the morale and efficiency problems that stemmed from a policy of segregation. This organization, under the guidance of Commander Christopher Sargent, was the vanguard of integration in Navy. In addition to ensuring that skill training was equally afforded to blacks, the Unit worked to make greater and more efficient use of fully-qualified personnel. This eventually led to the assignment in 1944 of 196 black seamen to the *USS Mason (DE 529)*, under the leadership of 44 white officers and petty officers. The *USS Mason* and four other patrol craft were so manned with the intention of replacing the White petty officers with blacks as soon as they became qualified. While this experiment demonstrated the ability for black sailors to perform well at sea, it also made a case for the integration of ships. [Ref 8:p.78]

3. The Need for Black Officers

The Special Programs Unit, among other things, brought to the forefront of senior Navy leadership the conclusion that "black sailors do not respond well when assigned to all-black organizations under white officers [Ref.8:p.78]." The pressing need to rectify the absence of blacks in the Navy's

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officer corps was ringing at the highest levels of the service. At that time, the only means of attaining a commission in the Navy was through the Naval Academy, the V-12 program, and direct commission. Because no blacks were attending the Academy, and due to the long lead time required of the V-12 program[3], direct commissioning became the expedient avenue for accessing the first black Naval officers.

By the end of 1943, senior Navy leaders decided that 22 officers, twelve line and ten staff, would be commissioned. Sixteen men, most of whom had college degrees, were chosen by three committees. All reported to a segregated training program established at the Great Lakes Training Center on 1 January 1944 as the first black officer candidates. These men all performed well in training, with posted grades indicating no failures. Over eight weeks into the training, it was announced that only twelve men would be commissioned [Ref.5 :p.99]. While all 16 completed training satisfactorily, 12 ensigns and one warrant officer were commissioned on 17 March

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[3]The V-12 program was initiated to ensure there was an adequate supply of educated personnel for Reserve officer training and to increase the size of college campus student bodies decimated by the war effort. The program enlisted personnel into the navy and paid their educational bills until graduation, at which time they went into officer training. Among the first V-12 officers were columnist and author, Carl T. Rowan, and VADM Samuel Gravely, the first Black Flag Officer. This was the forerunner of today's Nuclear Power Officer Candidate (NUPOC) program and the Baccalaureate Degree Completion Program (BDCP), both of which operate on the same principle.

1944. These "Golden Thirteen" became the first black members of the Navy officer corps.

Following the appointment of the first line officers, ten staff corps officers, including the first black Navy chaplains, were commissioned. These were the first 22 of nearly 60 to be commissioned during WWII.

C. BLACK OFFICER PARTICIPATION: A TRICKLE AT THE FLOOD GATES

With the first black officers in place and performing satisfactorily, the Navy sought to commission more. A limitation that would pervade the procurement of black officers for all of the services would be access to education.

1. The V-12 Program

The V-12 program, as described previously, provided 24 black officers by the end of WWII [Ref.5:p.230]. Still another 39 were enrolled in the training pipeline [Ref.8 :p.243]. Interestingly enough, prior to the selection of the sixteen candidates for training at Great Lakes, the V-12 program was not closed to blacks. Access to it was restricted primarily because of limited publicity among fleet sailors and black society. The chief limitation to the V-12 program was its placement among colleges. It was decided that black institutions would be specifically excluded from the program [Ref.8:p.247]. The Special Programs Unit, which had significant influence over that decision, argued that

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including black schools in the program would not be conducive to racial harmony, assuming that all blacks interested in being a Naval officer would attend only those schools. The few minorities who did participate attended predominantly White schools that did not exclude blacks from the student body.

2. U.S. Naval Academy

Prior to 1945, only five black men had been appointed to the U.S. Naval Academy at Annapolis. Three were appointed shortly after the Civil War. Two of these men would later resign, and the third was dismissed from the brigade. Two others started in 1936 and 1937. Both later resigned, one on a medical discharge, the other, James L. Johnson, for academic reasons. After Johnson's resignation, there were reports that hazing, mistreatment, and open discrimination against him were a major cause of his dismissal. He later accepted a commission in the Army Air Corps and was assigned to the first black combat aviation unit, the 99th Pursuit Squadron. [Ref.5 :p.95]

In 1944, Wesley A. Brown matriculated into the Brigade of Midshipmen and, in 1949, became the first black graduate from Annapolis. The Academy was not to become a major source of black officers soon after WWII for several reasons. First, it maintained very high admission standards that few blacks could reach, largely because of lack of access to elite

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preparatory schools that many aspiring midshipmen attended. Second, competition for appointments was keen and required a nomination from a legislator from one's home state. Few congressmen were willing to use one of their Academy nominations on a black applicant. By 1951, only four black midshipmen pursued commissions while residing in the dormitory of the Brigade.

3. The Holloway Scholarships

The third means of gaining a regular commission in the Navy was through the NROTC or Holloway Scholarship program. Students competed to attend any of fifty-five colleges and universities across the nation, none of which were predominantly black.

The administration of the program alone provides evidence that discrimination against black applicants existed. The Navy distributed the scholarships through state civilian committees, none of which had any black members. Eligibility depended in large part on the results of an aptitude test, the administration of which was seldom advertised in the black community. Several instances occurred when the test was advertised, but blacks were denied admission due to the racial policies of the testing center.

The placement of the NROTC units at which to use the Holloway scholarships was addressed by black leaders. When the program was expanded to 55 units in 1945, black schools

that applied were turned down, ostensibly "on the grounds of inadequacies in enrollment, academic credentials, and physical facilities."[Ref.8:p.247]   The Navy claimed it was not discriminating against the institutions. Black spokesmen for the Navy argued that the program would boost integration by attracting more black men to White colleges. Unfortunately, fourteen of the 55 NROTC schools maintained a statutory prohibition against black enrollment. Several other schools barred them as a matter of policy.

Many of the administrative barriers to blacks were addressed by the Navy, while others received only token attention. Ultimately, only six black officers would be commissioned through the Holloway scholarship program by 1948, and the program did not gain momentum in black society for many years. [Refs.8:pp.246-248, 5:pp.113-122]

4. NROTC at the HBCU

The Navy trails the other three military services in the Department of Defense in the area of black officer procurement   and   retention   [Ref. 10].   Black participation   in   the   NROTC   program   did   not   increase substantially until the late 1960s when units were established at six black colleges in the South [Ref. 11].

The first HBCU to gain an NROTC unit was Prairie View A & M College in 1967. This stemmed from specific efforts to increase the percentage of minority officers in all of the

services. The placement of the units was made possible because of the closure of programs at several predominantly white universities in the Northeast. Other HBCUs that presently host NROTC units are: Morehouse College; Southern University; Savannah State University; Florida A & M University; and the Hampton Roads consortium, which includes Hampton University and Norfolk State University. Placement of these units resulted in a substantial increase in minority participation in NROTC during the 1970s. By 1982, minority participation in the ROTC program constituted ten percent of the total enrollment [Ref.11:p.409].

The Navy, after bowing to social pressures to ostracize blacks, was the first military service to make a policy commitment to equal opportunity during the WWII years. Unfortunately, the policy commitment was not coupled with bold action, something that would plague the Navy until the 1970s.

Chapter III examines some of the literature pertinent to the analysis conducted in this thesis. It reviews research on officer performance and the influence of college resources on cognitive development.

III. LITERATURE REVIEW

A. GENERAL INFORMATION

No previous research could be found concerning the effects of college resources on Navy officer performance. However, previous studies have examined college resources on cognitive development and future job success. Also, numerous prior studies have discussed officer performance and alternative ways to measure it. The model developed in this thesis will draws primarily from research concerning the effects of college resources on the performance of blacks in a corporate environment. It also examines conclusions from studies linking educational factors on officer performance. The insights gained from the previous literature should aid in the development of a methodology for analyzing the effect of college resources on the performance of black naval officers.

B. OFFICER PERFORMANCE

The performance of black officers in the Navy was an issue in the 1988 report of the CNO Study Group on Equal Opportunity (EO) [Ref. 12]. The Study Group was commissioned by the CNO after the fiscal 1987 Military Equal Opportunity Assessment for the Navy revealed continued shortfalls by the service in the areas of minority officer procurement, minority officer promotions, and minority enlisted distribution and

advancement. The study specifically addressed the historical background of the Navy's EO efforts, the effectiveness of existing programs, and practices relating to officer and enlisted accession, distribution, and attrition. An examination of minority career progression was also done. Data for the study were collected through interviews and questionnaires with several thousand Navy personnel nationwide. The Group indicated that black officers do not fair as well as white officers at promotion and screening boards. This was attributed primarily to receiving fewer "all A" fitness reports and generally receiving lower fitness report (FITREP) grades than white officers. It confirmed that FITREPs were the primary record of performance used by boards for determining who the best officers are for promotion and key operational assignments. It also stated that officers who are not positively screened by administrative boards typically leaving the Navy or become non-competitive. An example is the screening of officers who will become eligible to attend Surface Warfare Department Head School. This usually takes place during an officer's first sea tour, and failure to be selected can mean an additional assignment at sea or remaining ineligible for assignment as a department head afloat. Missing such an assignment will make a Surface Warfare lieutenant much less competitive for promotion to lieutenant commander.

Lockman also examined some of these FITREP variations in his study, *Fitness Report Marks and Personal Characteristics of URL Lieutenants by Demographic and Gender Groups* [Ref. 13]. He compared the FITREP marks of black, Hispanic, and white unrestricted line officers of both genders and established some basic statistical trends for each group. The factors Lockman found to be important to promotion in FITREPs were a "sum of marks" and the recommendation for accelerated promotion (RAP). He also discovered that the nine specific aspects of performance marks, the five warfare specialty skills marks, mission contribution mark, the five desirability marks, and the six personal traits marks were highly correlated with each other. Because of this correlation, they were added to make a "sum of marks." Of black males in his sample, two-thirds graduated from "competitive" colleges and they performed better, as indicated by FITREP marks, than those individuals from noncompetitive schools.

Bowman examined the performance of naval officers who graduated from the Naval Academy. His study, *Do Engineers Make Better Naval Officers?: An Empirical Test of the Rickover Hypothesis*, looked at the relationship between college majors and officer performance [Ref. 14]. The Rickover Hypothesis states that naval officers with technical degrees perform better than officers without such degrees. Bowman found that the Rickhover Hypothesis could not be supported on

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the basis of officers who had graduated from the Naval Academy between 1976 and 1980.

The individuals from the Naval Academy are a select group who would probably do well in any environment. In Bowman's study, individuals who "self-selected" to join the nuclear Navy (as opposed to other Naval warfare communities) were probably high-achievers from the start. These individuals would be more likely to choose the nuclear Navy because of its advanced level of technology and its reputation which, as Bowman states, "has come to represent the 'cutting edge' for future Navy leaders." [Ref.14:p.8] Therefore, by not accounting for this selection factor, the results of his study could have been biased. This form of bias is called "selectivity bias." Selectivity bias can occur when an individual with a particular background makes a choice between two or more alternatives. Bowman attempted to correct for selectivity bias by using the Heckman procedure.

Bowman also included human capital assumptions in his model. Human capital is that part of the productive power of individuals that has been developed through earlier expenditures for education and other factors. Whether or not to allocate scarce resources to human capital comprises the human capital investment decision. The assumption is that an individual will only invest in human capital if his or her return is greater than the initial investment. Bowman equates

the measure of human capital investment to the choice of academic major. He writes:

> ...while an engineer major who achieves superior grades in engineering courses relative to others in his major possesses a greater quality of human capital. A similar argument could be made with regard to more general training for those majoring in the humanities. The model assumes that those with greater quantities and superior qualities of specific and general training ar more likely to achieve superior performance in the work world as a junior officer in the Navy. [Ref.14:p.275]

Bowman also relied on Fitreps to determine the measure of performance individuals displayed. To measure a junior officer's (JO) performance by FITREPs, the FITREP must be filed by a senior officer who has frequent contact with the JO, and must also be a FITREP that evaluates JOs in relation to their peers. Bowman found that the best grades to measure JO performance were: Recommended for Early Promotion, Top Ranking for "Command Desirability," and Top Ranking in the "Over-All Summary." When an individual met all of the previous measures, Bowman classified the individual with his single index, "superior." He used this as the dependent variable of his JO performance model. The individual was rated as a "superior" performer or he was not. This dichotomous dependent variable was best estimated by using a maximum likelihood "logit" model. Some of the productivity returns to education are discussed by Cymrot in his research memorandum, *Graduate Education and the Promotion of Officers* [Ref. 15]. Cymrot's study attempted to quantify the marginal benefit of graduate education to the Navy based on a

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gain in productivity of graduate-educated naval officers. He assumed this benefit would manifest itself in an increase in one's promotion probability.

Cymrot estimated a promotion probability function to determine the marginal educational benefit. Using a logistic model, he estimated the effect of graduate education on an officer's probability of promotion over time. He found that officers with graduate education were promoted at a faster rate and to higher levels than other officers.

The variables Cymrot used in his promotion probability model are of particular interest for this thesis. He used AGE, MALE, and RACE to adjust for some unobservable factors that might influence promotion potential. Because the current Navy promotion system is driven substantially by longevity, Cymrot included variables to represent one's time in rank and length of service. The model also included variables to account for institutional factors that influence promotion, specifically, one's warfare designator. Finally, he included variables to differentiate Unrestricted Line, Restricted Line, and Staff Corps officer status.

C. BLACK COLLEGES AND COLLEGE RESOURCES

Black College Attendance and *Job Success of Black College Graduates* by Solnick takes an insightful look at the job success of blacks and the influence of the college from which they graduated on that success [Ref.2]. This study assumes

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college attendance by blacks affects job success in two ways. First, one's ability to do well in any environment comes from one's cognitive ability. If cognitive development is something that is cultivated through study and experience, then it is highly likely that a college education will enhance one's cognitive ability.

Second, social skills acquired while attending college may be required to perform well in a predominantly white environment.

Solnick used three separate models to analyze the effects of college resources and socialization on job success of blacks who graduated from predominantly black colleges compared to those who graduated from predominantly white colleges.

The sample studied was of black employees of a Fortune 500 manufacturing firm. Personnel files from the firm were used to provide personal, demographic, educational, and job-related data on the individuals in the sample. These data were merged with resource information on the college from which each individual in the sample graduated. The resource data were taken from the Higher Education General Information Survey (HEGIS), provided by the Department of Education. By comparing blacks with other blacks, the results are assumed to be free of labor market discrimination factors. Furthermore, by choosing a single firm, job matching differences where controlled.

Solnick's first model estimated the influence of personal attributes, attendance at a black college, and productive resources of the college on starting salary. Solnick hypothesizes that the ability of a student will be based on the quality of the school he or she attended; therefore, measures of college resources are used to capture differences in ability. The assumption is that college resources primarily affect cognitive development, which directly correlates to job success.

Solnick's second model estimated the influence of personal attributes, attendance at a black college, and the ability differences of individuals on salary growth. The assumption made was that the unobserved ability difference controlled for in the starting salary model is observed by the firm and is shown in the salary growth of an individual.

Solnick's last model examined promotion within the firm. Promotion is different from salary growth in a few ways. When developing the promotion model, starting position must be taken into account because, within the firm, the functional divisions were found to have varying rates of promotion. Promotion was defined as an increase in salary grade level occurring within two years. Another difference in the promotion model was that the dependent variable was binary, unlike the continuous dependent variables used in the starting salary and salary growth models. The model estimated the influence of divisional differences, salary grade, year hired,

and college resources. Although performance ratings are major factors for determining who will get a promotion, no estimation of a model for performance ratings determination was done as part of Solnick's study. Therefore, they were specifically excluded from the model.

Solnick found that black graduates of predominantly black colleges received a higher starting salary, significantly lower salary growth rates, and a significantly lower probability of promotion than did blacks who graduated from non-black colleges. Furthermore, black colleges have lower endowments and provide fewer educational resources to their students than do non-black colleges. He also noted that non-black colleges devote significantly more resources to instruction than black colleges, even though black colleges tend to have a higher faculty-to-student ratio.

The literature cited here does not explicitly describe the type of analysis this thesis employs. It does, however, provide a framework and theoretical basis for examininig the relationship between college resources and officer performance. Chapter IV represents a detailed discussion of the data and methodology used in the analysis.

IV. DATA AND METHODOLOGY

A. DATA

The data used in this study were obtained from two separate sources and merged to form what is referred to as the officer data set. The first data file used was obtained from the Navy Personnel Research and Development Center (NPRDC), San Diego. This data file consisted of all the black officers in the Navy whose dates of first commissioning were between 1970 and 1990, and who were commissioned through the Naval Reserve Officer Training Corps (NROTC) scholarship and college programs, or the Officer Candidate School (OCS). The file included male and female officers from several communities, both line and staff, ranging in rank from ensign to commander. This initial sample included 1,998 records.

The sample was obtained by first listing, in numerical order, the social security numbers (SSNs) of officers who were commissioned from the sources and during the applicable years. This list was then matched with information from the Officer Master File (OMF) and the Officer Master/Loss File (OM/LF) by linking SSNs. The OMF contains a variety of information on the individual, including paygrade, sex, warfare designator, educational achievements, dates of rank, and commissioning source. Data from the OM/LF presents information such as

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separation reason for those officers who left the service during the period.

The officer SSNs and selected attributes from the OMF and OM/LF were then matched with every fitness report each officer had received during the period. This insured every fitness report had officer master/loss data appended to it. The SSNs were replaced by dummy identification numbers to protect the privacy of individuals. Once this match was completed, the file included 1,955 officers.

The second data file was obtained from the National Center for Education Statistics in the Department of Education. The Integrated Postsecondary Education Data System (IPEDS) public use tapes provided information on the college characteristics including financial, and student body data for the colleges attended by the officers in the sample. This data file was merged with the officer master/loss and fitness report file by matching the name of the college from which each officer graduated with the corresponding college name provided in the IPEDS file. To accomplish this, the Federal Interagency Committee on Education (FICE) code was appended to the college each individual attended. The FICE code is a unique numerical value given to an institution, and it is one way in which the colleges in the IPEDS files are identified. The FICE code became the common identifier for matching the data sets.

To appropriately analyze the probability of an individual being promoted to lieutenant commander, the newly merged data

set was further stratified to remove officers ineligible for promotion. The sample, hereafter referred to as the "officer data set," was left with 411 promotion-eligible black officers. All were commissioned through the NROTC scholarship and college programs or attended schools associated with the NROTC program. Each record included fitness report information, OMF and OM/LF data, and resource data on the college attended.

A Fitness Report (FITREP) selection criterion was applied to eliminate FITREPS that might bias the results of a multivariate analysis. Every FITREP received by an officer was included in the original file. However, every FITREP received by an officer is not acceptable for the purposes of this research. For a FITREP to be considered acceptable, it must meet certain criteria based on the occasion of the report, the type of report, and the basis of observation of the reporting senior. If the occasion is either periodic or detachment of reporting senior or both, then it is considered a "good" FITREP with respect to the occasion of the report. If the type is regular, as opposed to concurrent or special, the FITREP is "good" with respect to its type. If the basis for a FITREP was close, as opposed to frequent or infrequent, then it is deemed a "good" FITREP with respect to the observation basis of the report.

Using these criteria restricted the number of fitness reports used in the analysis to those in which the recipient

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of the report was evaluated with his peers. Eliminating reports that evaluated an officer individually ensured that only the most meaningful reports would be included in the analysis.

1. Variables

a. Dependent Variables

The dependent variables included in the analysis represent the probability of being promoted to lieutenant commander (LCDR), the probability of voluntarily leaving the Navy, and, of being recommended for accelerated promotion (RAP).

The dependent variable used to represent promotion, **PROMOTE**, was constructed by first identifying individuals who did not leave the service before being promoted to LCDR. This was done by inspecting the Bureau of Personnel Loss Code (BLC) included in the data set. Those who did not have a BLC listed or had voluntary loss codes after being promoted were grouped together and coded as 1. Those who had loss codes that indicated involuntary separation were coded as 0. Individuals who voluntarily left the service prior to being promoted would bias the estimation of promotion to LCDR, so these officers were dropped.

The dependent variable, **LEAVERS**, was constructed to control for voluntary losses. Officers with a BLC corresponding to voluntary separation prior to promotion to

LCDR were coded as 1; all others were coded as 0. The reason for this is to distinguish those officers who voluntarily left from those who remained and were later separated for failure to be promoted to LCDR.

A factor from the literature known to be highly correlated to promotion is the percentage of times an officer is recommended for early promotion to the next higher rank [Ref.14]. The continuous dependent variable, **EPLT**, is the percentage of times an officer received the RAP mark on "good" FITREPs. It was constructed to investigate how the independent variables chosen to estimate the promotion model influenced receiving the RAP mark.

a. Independent Variables

The variables used in this analysis were derived from, or drawn directly from, the data set described above. All of the independent variables are categorized to represent personal characteristics associated with officer potential, college characteristics and resources, and institutional aspects of the Navy that may affect promotability.

(1) Personal Attributes. It is recognized that promotion to LCDR is influenced by the innate personal ability factors of an individual. Limitations of the data require that the variables used as proxies for officer potential be rather broad. The offer of an NROTC scholarship to an individual indicates that he or she meets an appropriately high standard of conduct, discipline, academic achievement,

and officer potential. In the case of four-year scholarship recipients, individuals must also achieve above-average Scholastic Aptitude Test (SAT)[4] scores and high school academic requirements [Ref. 16]. Accepting a scholarship requires an individual to pursue a more technical overall course load that includes calculus and physics, regardless of one's chosen major. The ability to complete these additional courses may indicate possible academic or motivational differences between scholarship and contract students. This is represented by the dummy variable, **SCHOLAR**. Officers commissioned through the NROTC scholarship program were coded as 1; all others were coded as 0. The variable, **OCS,** was constructed to control for officers commissioned through the Officer Candidate School. These officers were coded as 1; all were coded as 0. **SCHOLAR** is expected to improve an officer's promotion probability and increase the probability of leaving.

The course of study or major initially selected by a college student is often more a function of interest than potential. Actually completing all course requirements and having a degree conferred provides some indication of an individual's academic ability and self-discipline. Selection of one's major is also a selection of the type of human capital that one takes on. Graduates of some majors are in

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[4]This also includes alternative College Board examinations.

greater demand by civilian industry than others, and those in
greater demand usually command higher salaries. Therefore,
selection of a major might be more indicative of one's long-
term intentions beyond the initial Navy obligation. Certain
majors also have close applicability to Navy occupations, such
as engineering to the nuclear power program. This can also
have an effect on promotability [Ref. 17]. Sixty-one
different majors were represented in the data set. These were
combined into four representative groups of dummy variables:
engineering **MAJENG**; physical sciences, **MAJSCI**; arts and
classics and other majors, **MAJOTH**. Social sciences and
business majors were included in the fourth and represents the
base case and, therefore, were not shown as a named variable.
Because of the Navy's stated emphasis on engineering and
science backgrounds, MAJENG is expected to positively
influence promotion and negatively influence retention. No
speculation is made for the other majors.

The last personal attribute relevant to this
analysis relates to the competitiveness of the college that
one attends. As discussed previously, the schools with the
most or the best resources are among the most prestigious.
They are also the most competitive or selective. These
institutions maintain very high admission standards with
respect to an applicant's previous academic achievement, SAT
scores, and personal qualifications. Only those students with
high levels of achievement and potential elect to apply to,

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and are admitted to, the most selective schools. *Barron's College Handbook* provides the most widely known and accepted measure of college selectivity known as the "Barron's Index." This index classifies almost every postsecondary institution in the United States and abroad into one of six categories: most competitive, highly competitive, very competitive, competitive, less competitive, and noncompetitive [Ref. 18]. The competitiveness of the college is used to capture one's academic ability and potential as it relates to choice of school. It was constructed by grouping the three highest ratings and the three lowest ratings into two categories. The highest categories were considered part of the base case and, therefore, were not listed by name. The dummy variable, **LESS**, was set equal to 1 for the three lowest categories.

(2) College Characteristics. The second set of factors thought to affect promotion is college attributes. The major emphasis in this study is on the resource characteristics of the college and their influence on promotion. The variables chosen to capture these attributes represent the public or private status of the institution, the source and allocation of funds, and whether the institution has historically maintained a predominantly black faculty and student body.

An institution's status as public or private is of interest because it is a major controlling force in

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determining how and from where the school acquires its revenue. Public schools receive the majority of their funding through federal and state appropriations, whereas private schools receive the bulk of their funding through endowments and other means. Due to the differences in the types of funding received, it is essential that public-private status be controlled. The individuals in this data set attended public, private non-profit, and private for-profit institutions. The dummy variable, **PRIVATE**, was set equal to 1 for private institutions to take this factor into consideration. No speculation is made as to the influence of this factor on promotion or retention.

The source and allocation of funds a college makes available for investment in human capital is the unique aspect of interest in this study. The amount of funding a college receives through federal appropriations is of particular interest because this is the type of funding over which the Navy might have some influence. This has important policy implications, which are discussed in a subsequent chapter. The way a college distributes its financial resources might be important to attracting and retaining better quality students. Furthermore, it has a direct effect on the education and cognitive development experienced by an individual. The resource information drawn from the data set includes enrollment, federal grants and contracts, endowment, total revenue, and student support. The federal grants and contract

amount was divided by enrollment[5] to create the variable **GRANTFTE**. The amount allocated for student support was divided by total appropriation to create the variable **STUSHARE**. These two variables were used to capture the influence of federal funding per student (on full time equivalent status) and percentage of total funding allocated to student support on promotion. Both resource variables are expected to positively influence promotion, but no prior assumption about their impact on retention is made.

The last college attribute that can influence a black officer's educational selection, and possibly his or her promotion opportunity, is whether or not the college he or she attends is an HBCU. Because HBCUs present a unique cultural and educational environment, attendance at one may influence an individual's performance as measured by the probability of promotion. Most HBCUs are categorized among the lower three *Barron's Index* classifications [Ref.18:p.1014]. By choosing to attend an HBCU, an individual also chooses a less selective school. If more selective colleges have more or better resources, comparing an individual from a more-selective school to an individual who attended a less-selective school could downwardly bias the effect of resources on promotion for an individual that attends a less-selective school. To control for this selectivity issue, an interactive variable

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[5] Enrollment is provided as Full-Time-Equivalent.

was created. The intent of this interactive variable is to capture the effect of an individual choosing an HBCU separate from the effect of it being less selective. Individuals in the data set who attended Florida A&M University, North Carolina Central University, Spelman College, Prairie View A&M University, Savannah State College, and Southern University were grouped together to create the dummy variable **HBCU**[6]. The interactive dummy variable, **LHBCU**, was created by combining the dummy variable, **HBCU**, with the dummy variable, **LESS**. HBCUs have less resources than non-HBCUs [Ref.2:p.135], so, in keeping with prior assumptions, the authors expect the influence of attending an HBCU to be negative on promotion and positive for retention.

(3) *Institutional Factors.* The Navy, like any other large institution, promotes its officers primarily according to evaluated criteria. Unlike the private sector, however, there are statutory limitations placed on certain occupations, which limit an officer's access to some billets. Some examples are the exclusion of women from the submarine force and the prohibition of restricted line and staff corps officers from commanding vessels at sea. Requirements for

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[6]Because of the way the data were stratified for promotion eligibility, officers from Morehouse College, Hampton University, and Norfolk State University were not included in the analysis. Officers commissioned through NROTC from these schools did not have sufficient length of service or time in grade necessary to be eligible for promotion to LCDR.

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certain numbers of officers with particular skills also influence the promotion opportunity for officers. To control for the institutional factors, a variable was constructed to represent designator differences, and an OMF variable was included to control for gender. The officers in the data set represented 30 different Navy communities. Officers from General Unrestricted Line (GUL), Surface Warfare (SWO), Undersea Warfare (SUBS), and Aviation (AIR) were aggregated into one category and used as the base case. All Restricted Line designators were grouped together under the dummy variable **RL.** Staff Corps officers, including those from medical communities, were represented by the dummy variable **SC.** Men were considered the base case and being female was captured by the dummy variable **FEMALE**. No speculation was made as to the influence of designator or gender on promotion or retention.

Another important factor to control for in estimating the probability of promotion is whether an individual has received postgraduate education or an advanced academic degree. This is significant for two reasons. First, Cymrot has shown postgraduate education to have a positive influence on promotion.[Ref. 15] Second, receiving postgraduate education is another means of building human capital. Using the assumptions made previously, the additional education an officer receives also adds the influence of additional college resources. Failing to control

for postgraduate education would upwardly bias an officer's promotion potential. The officers in the data set had education levels ranging from less than a bachelor's degree (BA/BS) through doctorate with various levels of credits toward the next higher degree. Because only 16 percent of the officers had degrees beyond a BA/BS, all those with a master's degree, post-master's credits, or a doctorate were included in the dummy variable, **POSTGRAD.**

B. METHODOLOGY

The purpose of this thesis is to examine differences between the performance of Naval officers commissioned through the NROTC program at an HBCU and officers who were commissioned through the NROTC program at non-HBCUs. The primary focus is the difference between resources available to institutions for reaching all educational goals. The primary measure of performance used is actual promotion experience from LT to LCDR. The methodology applied will test the hypothesis that, holding other factors constant, institutions with greater resources per student will produce officers who are likely to perform better than officers from schools with fewer resources.

The methodology used in this study to model promotion utilizes multivariate regression procedures, whereby causal factors are related to the observed outcome of being promoted to LCDR. Because the dependent variable is dichotomous, be

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promoted or fail to be promoted, the model form most appropriate for this analysis is a nonlinear maximum likelihood "logit" model. The method of maximum likelihood produces estimates that depend only on the logistic model; therefore, maximum likelihood estimates (MLE) are more robust than linear discriminant estimates [Ref. 19]. Since an individual has to remain in the Navy long enough to be eligible for promotion, a model is first developed to examine how explanatory variables influenced retention [Ref.15:p.5]. Because the decision to leave is also binary (stay or leave), this model can also estimate by MLE techniques.

The logit analysis is based on the logistic cumulative probability distribution and is defined as:

$$\text{prob}(y = 1) = \frac{1}{1 + \exp(-\text{beta } Xi)}$$

where a and the Bi's are the estimated parameters, and Xi's are the independent variables [Ref. 20]. The advantage of the "logit" over the linear probability model is that it constrains the output of the model to be within the (0,1) range and because of MLE, it tends to minimize the effects of heteroscedasticity [Ref. 21].

In the Navy, FITREP marks are the primary measure by which promotion is influenced. Because of the high collinearity between FITREP marks and promotion, they could not be used as independent variables in the promotion model. However,

because of their importance, it is useful to use FITREP measures as an alternative dependent variable. The method best suited for estimating the effects of the independent variables on **EPLT** is the ordinary least squares (OLS) regression technique.

C. **LIMITATIONS**

Several data and methodological limitations exist in this analysis. The data set itself is relatively small. This is due primarily to the low percentage of blacks in the Navy's officer corps, and rather low black participation in NROTC. The variables included in the model are proxies for factors known to affect promotion and retention. Variables representing personal characteristics such as grade point average and college board scores have a theoretical basis to be included. However, they were not available. Detailed background information on the officers included in the analysis, such as home of record, parental financial status, and high school record, also were not available.

Methodologically, the Heckman procedure, which would have aided in controlling for self-selection bias, could not be conducted because of the lack of background data. Self-selection problems would arise if an individual chose to attend an HBCU because of ineligibility to attend any other school. The methodology also does not control for changes in promotion opportunity for officers over time.

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V. ANALYSIS OF RESULTS

Interpretation of the estimated regression models is the key to understanding the influence of the variables discussed in Chapter IV on promotion, retention, and FITREP marks. To fully explain the influence of attending an HBCU and college resources on promotion and retention, three "logit" models were estimated, for each primary dependent variable, **PROMOTE** and **LEAVERS**. All of the models included variables representing personal and institutional characteristics. Model 1 then added only the variable for attending an HBCU; Model 2 included only variables representing college resources; and Model 3 included personal, institutional, college attendance, and resource variables.

In addition, three OLS models were estimated to examine the effect of the same set of explanatory variables on the alternative dependent variable, **EPLT**, the percentage of times the RAP mark was received on lieutenant FITREPs. The OLS models were estimated using the same combinations of independent variables described for the "logit" models.

The final officer data set included 441 black officers commissioned through the NROTC scholarship and college programs, and OCS. As discussed in Chapter IV (in the description of the primary dependent variable, **PROMOTE**),

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individuals who voluntarily left the service have been removed, thereby leaving 205 officers in the data set for estimating promotion.

A. PRELIMINARY DATA ANALYSIS

Table 1 provides the cross-tabulation of college attendance (HBCU or non-HBCU) and promotion to LCDR. Fifty-nine percent of the officers in the sample attended an HBCU. Slightly over 80 percent of those who were promotion-eligible were actually promoted. As seen in Table 1, of those who attended an HBCU, 76.9 percent were promoted, compared with 85.7 percent of non-HBCU attendees.

TABLE 1. NUMBER AND PERCENTAGE DISTRIBUTION OF BLACK NAVAL OFFICERS IN THE SAMPLE BY COLLEGE ATTENDANCE AND PROMOTION

	FREQUENCY PERCENT ROW PCT COL PCT	PROMOTED TO LCDR		
		NO	YES	TOTAL
COLLEGE ATTENDANCE	NON HBCU	12 5.85 14.29 30.00	72 35.12 85.71 43.64	84 40.98
	HBCU	28 13.66 23.14 70.00	93 45.37 76.86 56.36	121 59.02
	TOTAL	40 19.51	165 80.49	205 100.00

The distribution of officers who voluntarily left the Navy, as compared with those who remained to become eligible for promotion to LCDR is displayed in Table 2. Approximately 54 percent of the officers in the sample chose to leave the service prior to being promoted. Officers who attended an HBCU remained in the Navy at a slightly higher rate than officers graduating from non-HBCUs.

TABLE 2. NUMBER AND PERCENTAGE DISTRIBUTION OF BLACK NAVAL OFFICERS IN THE SAMPLE BY COLLEGE ATTENDANCE AND NAVY RETENTION BEHAVIOR

FREQUENCY PERCENT ROW PCT COL PCT	RETENTION BEHAVIOR		
	STAY	LEAVE	TOTAL
NON HBCU	83 18.82 45.86 40.69	98 22.22 54.14 41.35	181 41.04
HBCU	121 27.44 46.54 59.31	139 31.52 53.46 58.65	260 58.96
TOTAL	204 46.26	237 53.74	441 100.00

COLLEGE ATTENDANCE

The officers in the data set cover a broad range of designators, college types, education levels, and majors. As Table 3 shows, the largest percentage of the officers, 44.7 percent, were commissioned through the NROTC scholarship program. About 23 percent were NROTC contract students, and the remainder (32.4 percent) were commissioned through OCS.

Most of the officers were from the unrestricted line communities, with 17.5 percent of them as staff corps officers and five percent representing the restricted line communities. There were 48 women, representing almost 11 percent of the sample.

TABLE 3. MILITARY DATA OF OFFICERS IN THE SAMPLE

COMMISSIONING SOURCE

	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
SCHOLARSHIP	197	44.7	197	44.7
CONTRACT	101	22.9	298	67.6
OCS	143	32.4	441	100.0

DESIGNATOR

	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
URL	340	77.1	340	77.1
RESTRICTED LINE	24	5.4	364	82.5
STAFF CORPS	77	17.5	441	100.0

GENDER

	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
MALE	393	89.1	393	89.1
FEMALE	48	10.9	441	100.0

As Table 4 shows, the education level of the officers ranged from less than a bachelor's degree through doctorate. Almost 16 percent of the officers held at least a master's degree. Approximately 18 percent were educated at private schools. Over half of the officers held an undergraduate

TABLE 4. EDUCATIONAL DATA ON OFFICERS IN THE SAMPLE

GRADUATE EDUCATION

	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
BACHELOR'S	371	84.1	371	84.1
MASTER'S & ABOVE	70	15.9	441	100.0

COLLEGE CONTROL

	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
PUBLIC	362	.82.1	362	82.1
PRIVATE	79	17.9	441	100.0

COLLEGE MAJOR

	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
ARTS AND MEDICINE	57	12.9	57	12.9
PHYSICAL SCIENCE	42	9.5	81	22.4
ENGINEERING	80	18.1	161	40.5
BUSINESS / MGMT SOCIAL SCIENCES	262	59.4	423	100.0

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degree in business or one of the social sciences, and 18 percent graduated with an engineering degree.

Analysis of the resources of the colleges represented in the sample shows that HBCUs have, on the average, significantly fewer financial resources than non-HBCUs. T-Test results are shown in APPENDIX A. The amount of total revenue per full-time-equivalent (**TOTFTE**) received by non-HBCUs is nearly double that taken in by HBCUs. Non-HBCUs receive over one-third more funding through federal grants and contracts

(**GRANTFTE**) than HBCUs. Endowments (**ENDSHARE**) at non-HBCUs comprise over four-times the percentage of total revenues than those of HBCUs. The percentage of total revenues expended on student support (**STUSHARE**) at HBCUs is significantly higher than at non-HBCUs. Student support includes those areas not directly related to instruction, such as tutoring programs, academic counseling, and social programs. Table 5 compares the average amounts of student support (shares), endowment (shares), grants and contracts (per FTE), and total revenue (per FTE).

TABLE 5. A COMPARISON OF RESOURCE DATA AT NON-HBCUS AND HBCUS

VARIABLE*	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN
			NON HBCU			
STUSHARE	181	0.2016	0.1007	0.07386	0.5588	0.00749
ENDSHARE	156	0.0231	0.0377	0.00000	0.3933	0.00302
GRANTFTE	181	2472.91	3375.19	79.92	22206.63	250.88
TOTFTE	181	16706.24	14642.22	2086.41	92930.37	1088.35
			HBCU			
STUSHARE	260	0.2716	0.0472	0.17032	0.3315	0.00293
ENDSHARE	228	0.0045	0.0139	0.00000	0.0999	0.000922
GRANTFTE	260	1813.84	572.95	956.743	5201.18	35.53
TOTFTE	260	9440.02	4631.71	6552.33	35512.93	287.25

* Note: Variable definitions are provided in Chapter IV

The Pearson correlation coefficients are provided in Table 6. Two variables that displayed high correlation to each other were **OCS** and **SCHOLAR**. Also, the correlation coefficient between **LHBCU** and **STUSHARE** was .422. In view of the higher amounts spent at HBCUs on student support, this relatively high correlation is not completely unanticipated. As expected, high correlation also exists between the dependent variables, **EPLT** and **PROMOTE**.

B. MULTIVARIATE ANALYSIS

1. Promotion Models

a. Model 1 The first promotion model estimated using the "logit" technique attempts to capture the influence of attending an HBCU on promotion. The other independent variables used, as defined in Chapter IV, are: **LHBCU**, **MAJENG**, **MAJSCI**, **MAJOTH**, **POSTGRAD**, **SCHOLAR**, **OCS**, **RL**, **SC**, and **FEMALE**. The coefficient of each variable and the associated standard error and chi-square values, as well as the classification table are shown in Table 7. Included in Table 8 is each variable's likely effect on the probability of promotion. To determine the effects of a change in each explanatory variable on the probability of promotion, the beta coefficients were converted from the "logit" coefficients into more meaningful measures. A base case was computed to allow for comparisons of changes in the probability. The base case is defined as a

TABLE 6. PEARSON CORRELATION COEFFICIENTS

Variable*	PROMOTE	LEAVERS	EPLT	LHBCU	STUSHARE	GRANTFTE
PROMOTE	1.00000					
LEAVERS	0.04887	1.00000				
EPLT	**0.50589**	-0.23864	1.00000			
LHBCU	-0.10988	-0.01810	-0.16397	1.00000		
STUSHARE	0.09270	-0.07082	0.18441	**0.42281**	1.00000	
GRANTFTE	0.04169	0.01581	0.07214	-0.14575	-0.25765	1.00000
MAJENG	0.10304	0.00650	0.00225	0.08176	0.07709	0.16491
MAJSCI	0.04381	0.07297	0.05809	0.01944	0.02472	-0.01629
MAJOTH	0.00977	0.02377	0.07051	-0.03580	0.04710	-0.02268
POSTGRAD	0.27060	-0.34993	0.23225	-0.12955	0.04924	0.08764
SCHOLAR	0.21438	0.11452	-0.04454	-0.05429	0.00838	0.00230
OCS	0.16819	0.09826	-0.02671	-0.22953	-0.10938	-0.00021
RL	0.10342	-0.11486	0.05882	0.07824	-0.04377	0.21512
SC	0.07751	-0.08207	0.09900	-0.05339	0.04753	0.06045
FEMALE	0.09784	-0.19651	0.17735	-0.09324	0.01061	-0.01609
PRIVATE	0.13019	0.01282	0.07899	-0.24735	-0.12762	0.31266

* Note: Variable definitions are provided in Chapter IV
-continued-

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TABLE 6. (CONTINUED) PEARSON CORRELATION COEFFICIENTS

Variable	MAJENG	MAJSCI	MAJOTH	POSTGRAD	SCHOLAR	OCS
PROMOTE	0.10304	0.04381	0.00977	0.27060	0.21438	0.16819
LEAVERS	0.00650	0.07297	0.02377	-0.34993	0.11452	0.09826
EPLT	0.00225	0.05809	0.07051	0.23225	-0.04454	-0.02671
LHBCU	0.08176	0.01944	-0.03580	-0.12955	-0.05429	-0.22953
STUSHARE	0.07709	0.02472	0.04710	0.04924	0.00838	-0.10938
GRANTFTE	0.16491	-0.01629	-0.02268	0.08764	0.00230	-0.00021
MAJENG	1.00000	-0.15273	-0.18137	-0.02735	-0.22800	-0.23810
MAJSCI	-0.15273	1.00000	-0.12500	-0.05637	-0.09693	-0.04322
MAJOTH	-0.18137	-0.12500	1.00000	-0.05637	0.03348	0.06522
POSTGRAD	-0.02735	-0.05637	-0.05637	1.00000	0.14067	0.07028
SCHOLAR	-0.22800	-0.09693	0.03348	0.14067	1.00000	**0.62244**
OCS	-0.23810	-0.04322	0.06522	0.07028	0.62244	1.00000
RL	0.09458	0.05838	-0.03284	0.05992	-0.02571	-0.01671
SC	-0.03051	-0.02713	-0.01696	0.20886	0.04081	0.12801
FEMALE	-0.10784	-0.03898	0.01727	0.22676	0.19686	0.17787
PRIVATE	-0.06646	0.00959	0.04916	0.05600	0.09861	0.24486

—continued—

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TABLE 6. (CONTINUED) PEARSON CORRELATION COEFFICIENTS

Variable	RL	SC	FEMALE	PRIVATE
PROMOTE	0.10342	0.07751	0.09784	0.13019
LEAVERS	-0.11486	-0.08207	-0.19651	0.01282
EPLT	0.05882	0.09900	0.17735	0.07899
LHBCU	0.07824	-0.05339	-0.09324	-0.24735
STUSHARE	-0.04377	0.04753	0.01061	-0.12762
GRANTFTE	0.21512	0.06045	-0.01609	0.31266
MAJENG	0.09458	-0.03051	-0.10784	-0.06646
MAJSCI	0.05838	-0.02713	-0.03898	0.00959
MAJOTH	-0.03284	-0.01696	0.01727	0.04916
POSTGRAD	0.05992	0.20886	0.22676	0.05600
SCHOLAR	-0.02571	0.04081	0.19686	0.09861
OCS	-0.01671	0.12801	0.17787	0.24486
RL	1.00000	-0.11034	-0.05175	0.04433
SC		1.00000	-0.02649	0.08110
FEMALE			1.00000	0.15952
PRIVATE				1.00000

male unrestricted line officer, commissioned through the NROTC college program, who majored in social sciences or business, and holds only an undergraduate degree from a public institution. This procedure is used for all of the "logit" models in this study.

(1) Personal Attributes. In the first promotion model (Model 1) the variables **MAJENG** and **MAJSCI** indicate that individuals receiving a degree in engineering and physical science are more likely to be promoted than are those who major in business, management, the social sciences, and arts and humanities.[Ref. 14] This result is consistent with those of previous studies. These variables are significant at the 95-percent and 90-percent confidence levels, respectively. In this model, the probability of being promoted for the base case is 41 percent. The probability of being promoted for engineering and physical sciences is substantially higher at 74 percent and 72 percent, respectively.

(2) Institutional Factors. The variable **POSTGRAD** is significant at the 99-percent confidence level. This result represents the fact that having a postgraduate education significantly enhances one's chances of being promoted. This result also is consistent with prior research.[Ref. 15] Possession of a postgraduate education increases the probability of promotion.

(3) Attending an HBCU. Attending an HBCU did not have a significant effect on promotion in the model. However,

TABLE 7. MODEL 1: EFFECTS OF HBCU AND OTHER ATTRIBUTES ON THE PROMOTION OF BLACK NAVAL OFFICERS

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	
INTERCEPT	0.36121040	0.41791578	0.75	
LHBCU	-0.41848857	0.42447132	0.97	
MAJENG	1.43470303	0.61051069	5.52	**
MAJSCI	1.35357712	0.83783179	2.61	*
MAJOTH	0.63691016	0.58062924	1.20	
POSTGRAD	2.33176060	0.77977400	8.94	***
SCHOLAR	0.84815801	0.54168399	2.45	
OCS	0.61694692	0.70795264	0.76	
RL	1.55917864	1.09226897	2.04	
SC	-0.00144853	0.57438068	0.00	
FEMALE	-0.06628822	0.65513644	0.01	

CLASSIFICATION TABLE

PREDICTED

		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	13	27	40
	POSITIVE	13	152	165
	TOTAL	26	179	205

SENSITIVITY: 92.1%   SPECIFICITY: 32.5%   CORRECT: 80.5%
FALSE POSITIVE RATE: 15.1%   FALSE NEGATIVE RATE: 50.0%

*   Significant at 90 percent confidence level
**   Significant at 95 percent confidence level
*** Significant at 99 percent confidence level

the probability of being promoted for a non-HBCU graduate was 41 percent, and the probability decreased by nine percent for individuals who attended HBCUs.

b. Model 2

Model 2 attempts to isolate the effects of college resources on promotion. This model consists of the same independent variables as in the previous one. It differs from the first promotion model in that it uses the two resource variables, **STUSHARE** and **GRANTFTE**, described in Chapter IV,

TABLE 8. MODEL 1: CHANGES IN THE PROBABILITIES OF PROMOTION FOR BLACK NAVAL OFFICERS

VARIABLE	PROB	DELTA	BETA	X
BASECASE (BC)	0.4107			
BC + LHBCU	0.3144	-.0963	-.4185	1.0000
BC + MAJENG	0.7453	0.3346	1.4347	1.0000
BC + MAJSCI	0.7296	0.3189	1.3536	1.0000
BC + MAJOTH	0.5685	0.1578	0.6369	1.0000
BC + POSTGRAD	0.8777	0.4670	2.3318	1.0000
BC + SCHOLAR	0.6194	0.2087	0.8482	1.0000
BC + OCS	0.5636	0.1529	0.6169	1.0000
BC + RL	0.7682	0.3575	1.5592	1.0000
BC + SC	0.4103	-.0004	-.0014	1.0000
BC + FEMALE	0.3947	-.0159	-.0663	1.0000

and excludes the variable that represents attendance at an HBCU. Table 9 displays the beta coefficients, mean values, chi-square values, and the classification table. The probable effects of each variable are provided in Table 10.

(1) *College Characteristics*. The resource variables that were significant in this model were **GRANTFTE** and **PRIVATE**. This result implies that the more funding an institution receives through grants and contracts, the more likely officers who have attended the institution are to be promoted. Also, attendance at a private institution enhances one's ability to be promoted. **GRANTFTE** was significant at the 99-percent confidence level, while **PRIVATE** was significant at the 90-percent confidence level. For an arbitrary thousand dollar increase in funds (per FTE) provided through grants and contracts, the probability of being promoted increases by five percent. The probability of promotion increases by 20 percent

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TABLE 9 MODEL 2: EFFECTS OF RESOURCES AND OTHER FACTORS ON THE PROMOTION OF BLACK NAVAL OFFICERS

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	
INTERCEPT	0.06753402	0.81086631	0.01	
STUSHARE	1.58260970	3.01561465	0.28	
GRANTFTE	0.00030132	0.00011192	7.25	***
MAJENG	1.79117462	0.64810506	7.64	***
MAJSCI	1.18331361	0.86630490	1.87	
MAJOTH	0.58659337	0.60114611	0.95	
POSTGRAD	2.64162974	0.83354832	10.04	***
SCHOLAR	0.91163180	0.55522907	2.70	*
OCS	0.45861158	0.73393360	0.39	
RL	1.69356764	1.16145405	2.13	
SC	0.14966861	0.59657274	0.06	
FEMALE	-0.16018086	0.69833081	0.05	
PRIVATE	1.70443126	0.84736806	4.05	*

CLASSIFICATION TABLE

PREDICTED

		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	12	28	40
	POSITIVE	12	153	165
	TOTAL	24	181	205

SENSITIVITY: 92.7%   SPECIFICITY: 30.0%   CORRECT: 80.5%
FALSE POSITIVE RATE: 15.5%   FALSE NEGATIVE RATE: 50.0%

*   Significant at 90 percent confidence level
*** Significant at 99 percent confidence level

if the individual attends a private college. Even though **STUSHARE** was not significant in the model, a ten percent increase in the percentage of money spent on student support would increase the probability of promotion by almost three percent.

(2) Personal Attributes. In this model majoring in engineering was significant at the 99-percent confidence level. As in the previous model, it exercises a very positive influence on promotion.   A black officer's

TABLE 10. MODEL 2: CHANGES IN THE PROBABILITIES OF PROMOTION FOR BLACK NAVAL OFFICERS

VARIABLE	PROB	DELTA	BETA	X
BASECASE (BC)	0.7487			
BC + STUSHARE	0.7773	0.0286	1.5826	0.1000
BC + GRANTFTE	0.8011	0.0524	0.0003	1000.0000
BC + MAJENG	0.9470	0.1983	1.7912	1.0000
BC + MAJSCI	0.9068	0.1581	1.1833	1.0000
BC + MAJOTH	0.8427	0.0940	0.5866	1.0000
BC + POSTGRAD	0.9766	0.2279	2.6416	1.0000
BC + SCHOLAR	0.8812	0.1324	0.9116	1.0000
BC + OCS	0.8250	0.0762	0.4586	1.0000
BC + RL	0.9419	0.1931	1.6936	1.0000
BC + SC	0.7758	0.0271	0.1497	1.0000
BC + FEMALE	0.7174	-.0313	-.1602	1.0000
BC + PRIVATE	0.9425	0.1937	1.7044	1.0000

probability of being promoted if he or she majored in business, management, or one of the social sciences is 75 percent as compared with almost 95 percent for engineering majors. **SCHOLAR** has a positive coefficient and is significant at the 90-percent confidence level. The change in the probability of being promoted for scholarship commissionees is 16 percent.

(3) *Institutional Factors*. Individuals who had a postgraduate degree were 23 percent more likely to be promoted than those without a it. The variable **POSTGRAD** was positive and highly significant in the model.

c. *Models 1 and 2*

Model 3 uses attendance at an HBCU, resources, personal attributes, college characteristics, and the institutional variables. In the previous promotion models, the influence of attending an HBCU (or the effect of

resources) was estimated separately to determine how each characteristic performed independently. This model attempts to capture the combined influence of these variables on promotion. Table 11 lists the beta coefficients, chi-square values, classification table, and significance levels. Table 12 lists the probabilities.

TABLE 11.   MODEL 3: EFFECTS OF HBCU ATTENDANCE AND RESOURCES FOR THE PROMOTION OF BLACK NAVAL OFFICERS

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	
INTERCEPT	-0.07405139	0.88142564	0.01	
LHBCU	-0.70920299	0.64898201	1.19	
STUSHARE	4.41683057	4.31243385	1.05	
GRANTFTE	0.00029986	0.00011286	7.06	***
MAJENG	1.66887457	0.65571810	6.48	***
MAJSCI	1.23158000	0.86873040	2.01	
MAJOTH	0.53183377	0.60729524	0.77	
POSTGRAD	2.56153593	0.83910483	9.32	***
SCHOLAR	0.92433697	0.55708967	2.75	*
OCS	0.32949202	0.74383623	0.20	
RL	1.83522782	1.17775971	2.43	
SC	0.17936529	0.59730171	0.09	
FEMALE	-0.11641854	0.70185562	0.03	
PRIVATE	1.42034504	0.89291327	2.53	

CLASSIFICATION TABLE

		PREDICTED		
		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	16	24	40
	POSITIVE	12	153	165
	TOTAL	28	177	205

SENSITIVITY: 92.7%   SPECIFICITY: 40.0%   CORRECT: 82.4%

FALSE POSITIVE RATE: 13.6%   FALSE NEGATIVE RATE: 42.9%

*   Significant at 90 percent confidence level
*** Significant at 99 percent confidence level

(1) College Characteristics. In this model, the funding received through grants and contracts per full-time-equivalent **(GRANTFTE)** was significant at the 99-percent confidence level, and positive for promotion. Assuming the same increase of one-thousand dollars in **GRANTFTE**, the probability of promotion increase by almost four percent. Although not significant in this model, an assumed increase of ten percent in the share of total revenue used for student support **(STUSHARE)** would increase the probability of promotion by five percent.

TABLE 12. MODEL 3: CHANGES IN PROBABILTY OF PROMOTION FOR BLACK NAVAL OFFICERS

VARIABLE	PROB	DELTA	BETA	X
BASECASE (BC)	0.8388			
BC + LHBCU	0.7191	-.1197	-.7092	1.0000
BC + STUSHARE	0.8900	0.0512	4.4168	0.1000
BC + GRANTFTE	0.8754	0.0366	0.0003	1000.0000
BC + MAJENG	0.9651	0.1262	1.6689	1.0000
BC + MAJSCI	0.9469	0.1081	1.2316	1.0000
BC + MAJOTH	0.8986	0.0597	0.5318	1.0000
BC + POSTGRAD	0.9854	0.1466	2.5615	1.0000
BC + SCHOLAR	0.9292	0.0903	0.9243	1.0000
BC + OCS	0.8786	0.0398	0.3295	1.0000
BC + RL	0.9702	0.1314	1.8352	1.0000
BC + SC	0.8616	0.0228	0.1794	1.0000
BC + FEMALE	0.8224	-.0164	-.1164	1.0000
BC + PRIVATE	0.9556	0.1168	1.4203	1.0000

(2) Attending an HBCU. The variable used to capture the influence of attending an HBCU **(LHBCU)** was not significant in this model. Therefore, no sound inferences can

be made as to its negative or positive effect on the performance of black Naval officers.

(3) *Institutional Factors.* Postgraduate education, as in each of the prior models, is highly significant and positive. The probability of being promoted increases by almost 15 percent if an individual has a postgraduate education. Another institutional factor that was not significant in either of the other two models, but is significant at the 90-percent confidence level in this model, is **SCHOLAR**. This variable, as described in Chapter IV, is used to control for the difference between officers who are commissioned through OCS and NROTC scholarship or college programs. Officers who are commissioned through the NROTC scholarship program have a significantly greater chance of being promoted than do their counterparts commissioned through the other two sources. The probability of promotion increases by nine percent for scholarship officers.

(4) *Personal Attributes.* The most important personal attribute appears to be whether or not an individual focussed his course of study in engineering while in college. In this model, as well as in the prior two, **MAJENG** is significant at the 99-percent confidence level. The probability of promotion increases by 12 percent for those individuals who chose to major in engineering.

2. Retention Models

In the promotion models, the individuals who voluntarily left the service prior to being promotion-eligible were dropped from the model. However, the authors felt compelled to analyze how the factors that influence promotion would influence the decision of those who voluntarily left. The dependent variable, **LEAVERS**, is as described in Chapter IV. Three retention models are estimated in an attempt to capture the separate and combined influences of attending an HBCU and the effect of college resources on one's decision to voluntarily leave the service.

a. Model 1 (Retention)

The results derived from the first retention model are interpreted from the classification table, beta coefficients, chi-square values and probabilities in Table 13 and Table 14.

(1) Attending an HBCU. In the first retention model, the influence of attendance at an HBCU is not significant. However, the probability of an individual remaining in the Navy increases by five percent if he attended an HBCU.

(2) Institutional Factors. The primary influence on retention is due to these variables. All of the categories represented by the institutional factor variables are significant. The significant institutional factor representing designator is **RL**. An individual from the

TABLE 13. MODEL 1: EFFECTS OF HBCU AND OTHER FACTORS ON THE ATTRITION OF BLACK NAVAL OFFICERS

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	
INTERCEPT	0.19127781	0.24205297	0.62	
LHBCU	-0.21472874	0.22884627	0.88	
MAJENG	0.29141904	0.29534234	0.97	
MAJSCI	0.66071737	0.38529690	2.94	*
MAJOTH	0.06685498	0.32579900	0.04	
POSTGRAD	-2.40602964	0.40199402	35.82	***
SCHOLAR	0.87665689	0.29021717	9.12	***
OCS	0.21517367	0.32160833	0.45	
RL	-1.21144517	0.50722406	5.70	**
SC	-0.27736830	0.30066047	0.85	
FEMALE	-1.44136008	0.39431818	13.36	***

CLASSIFICATION TABLE

PREDICTED

		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	115	89	204
	POSITIVE	56	181	237
	TOTAL	171	270	441

SENSITIVITY: 76.4% SPECIFICITY: 56.4% CORRECT: 67.1%
FALSE POSITIVE RATE: 33.0% FALSE NEGATIVE RATE: 32.7%

*   Significant at 90 percent confidence level
**   Significant at 95 percent confidence level
*** Significant at 99 percent confidence level

restricted line community is significantly (95-percent confidence level) more likely to remain in the service than an individual from any other community. The probability of individuals in the restricted line community staying in the Navy increases by 25 percent over individuals who represent the unrestricted line community. The other institutional variable found to be significant is **FEMALE**. This variable indicates that women are more likely to remain in the Navy

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TABLE 14. MODEL 1 : CHANGES IN PROBABILITY OF ATTRITION FOR BLACK NAVAL OFFICERS

VARIABLE	PROB	DELTA	BETA	X
BASECASE(BC)	0.4523			
BC + LHBCU	0.3999	-.0525	-.2147	1.0000
BC + MAJENG	0.5250	0.0727	0.2914	1.0000
BC + MAJSCI	0.6153	0.1629	0.6607	1.0000
BC + MAJOTH	0.4689	0.0166	0.0669	1.0000
BC + POSTGRAD	0.0693	-.3830	-2.4060	1.0000
BC + SCHOLAR	0.6649	0.2126	0.8767	1.0000
BC + OCS	0.5060	0.0536	0.2152	1.0000
BC + RL	0.1974	-.2549	-1.2114	1.0000
BC + SC	0.3849	-.0674	-.2774	1.0000
BC + FEMALE	0.1635	-.2889	-1.4414	1.0000

than men, and its influence is significant at the 99 percent confidence level. Also, the probability of women remaining in the service is 29 percent greater than that of their male counterparts. Lastly, individuals having a postgraduate education tend to remain in the service at a 38 percent greater probability than those without it. POSTGRAD is significant at the 99-percent confidence level.

(3) *Personal Attributes*. Of the personal attribute variables, the individuals who received their commissions through the NROTC scholarship program were 20 percent more likely to leave the Navy than someone who was commissioned through the NROTC college program or OCS. The variable representing this effect, **SCHOLAR**, is significant at the 99-percent confidence level. Majoring in physical science, **MAJSCI**, has a significant negative effect on retention at the 90-percent confidence level. These individuals have a 16

percent higher likelihood of leaving the Navy over social science and business majors.

b. Model 2 (Retention)

The results of the second model, which analyzes the effects of resources on retention, are found in Tables 15 and 16.

TABLE 15. MODEL 2: EFFECTS OF RESOURCES AND OTHER FACTORS ON RETENTION OF BLACK NAVAL OFFICERS.

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	
INTERCEPT	0.26406697	0.42384477	0.39	
STUSHARE	-1.33971784	1.46167423	0.84	
GRANTFTE	0.00005654	0.00005918	0.91	
MAJENG	0.27218274	0.30144442	0.82	
MAJSCI	0.68247318	0.38897765	3.08	*
MAJOTH	0.10194684	0.32644576	0.10	
POSTGRAD	-2.38628601	0.40042580	35.51	***
SCHOLAR	0.87714247	0.29115862	9.08	***
OCS	0.19746075	0.32584894	0.37	
RL	-1.38470504	0.52245229	7.02	***
SC	-0.29586294	0.30345070	0.95	
FEMALE	-1.47727593	0.40158845	13.53	***
PRIVATE	0.13058925	0.31434701	0.17	

CLASSIFICATION TABLE

		PREDICTED		
		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	98	106	204
	POSITIVE	43	194	237
	TOTAL	141	300	441

SENSITIVITY: 81.9% SPECIFICITY: 48.0% CORRECT: 66.2%
FALSE POSITIVE RATE: 35.3% FALSE NEGATIVE RATE: 30.5%

*   Significant at 90 percent confidence level
*** Significant at 99 percent confidence level

(1) College Characteristics. The effects the college characteristic variables (STUSHARE, GRANTFTE, and

PRIVATE) have on retention were insignificant, when modeled

independent of the influence of attendance at an HBCU.

TABLE 16. MODEL 2: CHANGES IN THE PROBABILITY OF RETENTION FOR BLACK NAVAL OFFICERS

VARIABLE	PROB	DELTA	BETA	X
BASECASE (BC)	0.5141			
BC + STUSHARE	0.4807	-.0335	-1.3397	0.1000
BC + GRANTFTE	0.5283	0.0141	0.0001	1000.0000
BC + MAJENG	0.5815	0.0673	0.2722	1.0000
BC + MAJSCI	0.6768	0.1626	0.6825	1.0000
BC + MAJOTH	0.5396	0.0254	0.1019	1.0000
BC + POSTGRAD	0.0887	-.4255	-2.3863	1.0000
BC + SCHOLAR	0.7166	0.2025	0.8711	1.0000
BC + OCS	0.5632	0.0490	0.1975	1.0000
BC + RL	0.2095	-.3047	-1.3847	1.0000
BC + SC	0.4405	-.0737	-.2959	1.0000
BC + FEMALE	0.1946	-.3196	-1.4773	1.0000
BC + PRIVATE	0.5467	0.0325	0.1306	1.0000

(2) Institutional Factors. The institutional factors designator, gender, and graduate education are all significant at the 99-percent confidence level. An individual from the restricted line community has a 30 percent greater probability of staying in the Navy when compared with someone in the unrestricted line community. A women is 32 percent more likely to stay in the Navy than her male counterpart. Lastly, in this retention model, a graduate education increases the probability of staying in the Navy by 43 percent.

(3) Personal Attributes. The only personal attribute variable found to be significant on retention in this model was **SCHOLAR**. Having received an NROTC scholarship

TABLE 17. MODEL 3: EFFECTS OF HBCU, RESOURCES AND OTHER FACTORS ON THE RETENTION OF BLACK NAVAL OFFICERS

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	
INTERCEPT	0.26418328	0.42491359	0.39	
LHBCU	-0.07956890	0.26127137	0.09	
STUSHARE	-1.12428922	1.62887128	0.48	
GRANTFTE	0.00005682	0.00005917	0.92	
MAJENG	0.27134525	0.30163832	0.81	
MAJSCI	0.68055481	0.38909242	3.06	*
MAJOTH	0.09555322	0.32737620	0.09	
POSTGRAD	-2.40100347	0.40364014	35.38	***
SCHOLAR	0.88407346	0.29204764	9.16	***
OCS	0.18407894	0.32875629	0.31	
RL	-1.36336014	0.52666312	6.70	***
SC	-0.29502702	0.30343385	0.95	
FEMALE	-1.47414692	0.40168234	13.47	***
PRIVATE	0.11209321	0.31975474	0.12	

CLASSIFICATION TABLE

		PREDICTED		
		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	102	102	204
	POSITIVE	49	188	237
	TOTAL	151	290	441

SENSITIVITY: 79.3% SPECIFICITY: 50.0% CORRECT: 65.8%
FALSE POSITIVE RATE: 35.2% FALSE NEGATIVE RATE: 32.5%

*   Significant at 90 percent confidence level
*** Significant at 99 percent confidence level

negatively influences an individual's decision to remain in the Navy. Individuals who were commissioned through the NROTC scholarship program were 20 percent more likely to leave the Navy than were OCS or NROTC college program commissionees. Physical science majors have a 16 percent higher probability than business/management or social science majors of leaving the Navy.

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c. Model 1 and 2 (Retention)

The results of the model attempting to capture the combined influence of attending an HBCU and the effect of college resources on retention are displayed in Table 17 and Table 18. These results reveal the following:

TABLE 18. MODEL 3: CHANGES IN PROBABILITY OF ATTRITION FOR BLACK NAVAL OFFICERS

VARIABLE	PROB	DELTA	BETA	X
BASECASE (BC)	0.3968			
BC + LHBCU	0.3779	-.0189	-.0796	1.0000
BC + STUSHARE	0.3702	-.0266	-1.1243	0.1000
BC + GRANTFTE	0.4105	0.0137	0.0001	1000.0000
BC + MAJENG	0.4632	0.0664	0.2713	1.0000
BC + MAJSCI	0.5651	0.1683	0.6806	1.0000
BC + MAJOTH	0.4199	0.0231	0.0956	1.0000
BC + POSTGRAD	0.0563	-.3405	-2.4010	1.0000
BC + SCHOLAR	0.6143	0.2175	0.8841	1.0000
BC + OCS	0.4416	0.0448	0.1841	1.0000
BC + RL	0.1440	-.2528	-1.3634	1.0000
BC + SC	0.3288	-.0681	-.2950	1.0000
BC + FEMALE	0.1309	-.2659	-1.4741	1.0000
BC + PRIVATE	0.4239	0.0271	0.1121	1.0000

(1) Attending an HBCU and College Characteristics. The variables used to capture the combined influence of **LHBCU**, **STUSHARE**, **GRANTFTE**, and **PRIVATE** on retention were not significant. However, the comparison of the probabilities between these variables shows that, as resources were added to the HBCU model, the probability of an individual from an HBCU staying in the Navy decreases.

(2) Personal Attributes. Unlike the other two retention models, individuals who received undergraduate

degrees in physical science were significantly less likely to stay. The probability of a physical science major leaving the Navy is almost 17 percent higher than that for an individual who received a degree in business or one of the social sciences. Also, as in the other models, NROTC scholarship commissionees were significantly more likely to leave the Navy than the other officers in the sample.

(3) *Institutional Factors*. As in the prior retention models, institutional factors are important to retention. **POSTGRAD**, **RL**, and **FEMALE** are all significant in this model and demonstrate the same relationships as in the other two models. The comparison of probabilities between the three models (Tables 14, 16, and 18) demonstrates that resources have the greater influence on these institutional factors with respect to retention than does the effect of attending an HBCU or the combined effect.

3. Early Promotion Models

Prior research has indicated the necessity for the factors that measure performance to be modeled independent of promotion. The following models use the continuous dependent variable **EPLT**, described in Chapter IV, to analyze promotion. The independent variables, and the process by which they were used to determine their separate and combined influences, are the same as those described previously in this chapter. These

models use the OLS regression technique instead of the "logit" technique.

a. Model 1

The first model attempts to capture the effects of attending an HBCU independent of college characteristics. Table 19 shows the analysis of variance, parameter estimates, and T values provided from the OLS model estimation.

(1) Attending an HBCU. The variable representing attendance at an HBCU, **LHBCU**, was negative and significant at the 95 percent confidence level on the dependent variable, **EPLT**. The negative effect indicates that the percentage of times an individual received a recommendation for early promotion as a LT (**EPLT**) is less for black officers who attended an HBCU than for those that attended a non-HBCU.

(2) Institutional Factors. In this model there are two institutional variables that are significant at the 95-percent confidence level or better. The effect of having a postgraduate education (**POSTGRAD**) increases **EPLT**, while **FEMALE** has a positive effect on the dependent variable.

b. Model 2

This model was estimated to analyze the effects of college characteristics on FITREPs. The results of this model are shown in Table 20.

(1) College Characteristics. Unlike the promotion model, none of the college resource variables (**STUSHARE**,

TABLE 19. MODEL 1: ANALYSIS OF VARIANCE OF THE DEPENDENT VARIABLE EPLT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE
MODEL	10	1.20309931	0.12030993	2.768
ERROR	196	8.51832743	0.04346085	
C TOTAL	206	9.72142674		

ROOT MSE	0.2084727	R-SQUARE	0.1238
DEP MEAN	0.171236	ADJ R-SQ	0.0791
C.V.	121.7458		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	
INTERCEP	1	0.18068826	0.03279051	5.510	
LHBCU	1	-0.06411343	0.03082840	-2.080	*
MAJENG	1	0.01980804	0.04032649	0.491	
MAJSCI	1	0.05317103	0.04735434	1.123	
MAJOTH	1	0.06622109	0.04330263	1.529	
POSTGRAD	1	0.15347064	0.05627417	2.727	***
SCHOLAR	1	-0.02552696	0.04396375	-0.581	
OCS	1	-0.04221823	0.04743221	-0.890	
RL	1	0.05145590	0.08240281	0.624	
SC	1	0.04827400	0.04300507	1.1?3	
FEMALE	1	0.10720262	0.05147600	2.0ȶ	*

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*   Significant at 90 percent confidence level
*** Significant at 99 percent confidence level
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GRANTFTE, and **PRIVATE**) were significant in this model.

   (2) Institutional Factors. As seen in the HBCU model, the effect of the institutional variables (**POSTGRAD** and **FEMALE**), are significant and positive.

   c. Model 1 and 2

   Table 21 contains the results of the OLS regression that includes independent variables representing college

TABLE 20. MODEL 2: ANALYSIS OF VARIANCE OF THE DEPENDENT VARIABLE: EPLT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE
MODEL	12	1.22795093	0.10232924	2.337
ERROR	194	8.49347581	0.04378080	
C TOTAL	206	9.72142674		

ROOT MSE	0.2092386	R-SQUARE	0.1263
DEP MEAN	0.171236	ADJ R-SQ	0.0723
C.V.	122.1931		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	
INTERCEP	1	0.08136364	0.05639168	1.443	
STUSHARE	1	0.28284394	0.18854391	1.500	
GRANTFTE	1	.0000068814	0.000010617	0.648	
MAJENG	1	0.01683916	0.04141089	0.407	
MAJSCI	1	0.05830205	0.04762169	1.224	
MAJOTH	1	0.06334796	0.04355760	1.454	
POSTGRAD	1	0.14117415	0.05817085	2.427	**
SCHOLAR	1	-0.04373965	0.04419346	-0.990	
OCS	1	-0.01212684	0.04787268	-0.253	
RL	1	0.05374519	0.08293904	0.648	
SC	1	0.03329512	0.04437503	0.750	
FEMALE	1	0.11163023	0.05179367	2.155	*
PRIVATE	1	0.05407666	0.04159918	1.300	

* Significant at 90 percent confidence level
** Significant at 95 percent confidence level

characteristics, institutional factors, personal attributes, and attendance at an HBCU, and the dependent variable **EPLT**.

(1) *Attending an HBCU and College Characteristics.* In this model, the combined influence of attending an HBCU (**LHBCU**) and the college resource variable **STUSHARE** increased in significance. **LHBCU** and **STUSHARE** are significant at the 99-percent confidence level (Tables 19, 20, 21).

TABLE 21. **MODEL 3: ANALYSIS OF VARIANCE OF THE DEPENDENT VARIABLE EPLT**

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE
MODEL	13	1.59545600	0.12272738	2.915
ERROR	193	8.12597074	0.04210348	
C TOTAL	206	9.72142674		

ROOT MSE	0.2051913	R-SQUARE	0.1641
DEP MEAN	0.171236	ADJ R-SQ	0.1078
C.V.	119.8295		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	
INTERCEP	1	0.08316982	0.05530427	1.504	
LHBCU	1	-0.10123477	0.03426550	-2.954	***
STUSHARE	1	0.54929287	0.20571937	2.670	***
GRANTFTE	1	.0000047755	0.00001044	0.458	
MAJENG	1	0.01624902	0.04061037	0.400	
MAJSCI	1	0.05149857	0.04675728	1.101	
MAJOTH	1	0.04967409	0.04296507	1.156	
POSTGRAD	1	0.10713154	0.05819773	1.841	*
SCHOLAR	1	-0.03545189	0.04342932	-0.816	
OCS	1	-0.03240761	0.04744589	-0.683	
RL	1	0.07705127	0.08171640	0.943	
SC	1	0.02810335	0.04355214	0.645	
FEMALE	1	0.09812480	0.05099712	1.924	
PRIVATE	1	0.02987776	0.04160867	0.718	

*   Significant at 90 percent confidence level
*** Significant at 99 percent confidence level

VI. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

Analysis of the results shows that attending an HBCU does not have a significant effect on the probability of promotion to LCDR in the Navy. It does, however, have a significantly positive effect on retention. In addition, attending an HBCU adversely affects one's probability of receiving the RAP mark. The basic hypothesis of the thesis is supported in the finding that college resources have a significant and positive effect on promotion and receiving the RAP mark.

Of the other personal factors that influence promotion and retention, an engineering degree provides a significantly higher probability of promotion over other majors. Black officers who major in the physical sciences are more likely to leave the Navy. Those commissioned through the NROTC scholarship program are also more likely to get out of the Navy; however, for those who stay, having a scholarship enhances the probability of being promoted.

The most significant institutional factor is postgraduate education. It has a significantly positive effect on promotion, retention, and receiving the RAP mark. Finally, female officers and restricted line officers display a greater

propensity for staying in the Navy than do male unrestricted line officers.

B. DISCUSSION

Although attendance at an HBCU does not have a significantly negative impact on promotion in this analysis, there is evidence that officers educated at these institutions are promoted at a lower rate than other black officers. A discussion of the possible reasons for this phenomenon are beyond the scope of this thesis. However, one underlying cause may relate to the socialization of minority officers in the U.S. Navy, which is a predominantly white organization.

Socialization as a possible cause of performance variation among black officers has been discussed for decades. Unfortunately, no formal study has been conducted regarding its influence on officer performance. Interestingly, it was a voiced as a token concern of the Special Programs Unit as early as 1945 in deciding not to place V-12 or NROTC units at HBCUs. It was felt that doing so would not contribute to racial harmony because it was assumed that most blacks would gravitate toward those institutions and not immerse themselves into the Navy mainstream.[Ref. 8:p.47] Currently, students whose ability gives them wide latitude in choosing where to get an education often decide to attend a predominantly black college to avoid the culture shock associated with entering a

mainstream environment. For those with a desire to enter the Navy, such a move simply postpones the inevitable.

Solnick hypothesized that socialization into an organization may be an important factor in success on the job.[Ref. 2:p.136] Social skills are one of the products of a college education, but those who attend HBCUs obviously have fewer opportunities to acquire those skills with respect to a predominantly white working environment.

The CNO Study Group on Equal Opportunity investigated the fact that black officers have a lower rate of promotion to LCDR than that of their white counterparts. Flag officers interviewed by the Study Group indicated that training in how to be successful in the Navy environment would be helpful for minority officers in overcoming socialization hurdles. However, the extent of the influence of socialization was not determined by the Study Group. [Ref. 12:p.4-15]

In a recent briefing to OP-130, Bowman introduced a "value added" discussion to the comparison of various commissioning sources and their contribution to the quality of the officer corps.[Ref. 17] It would be useful to employ a similar evaluation criterion in considering the closure or consolidation of NROTC units. As the data indicate, black officers from HBCUs tend to stay in the Navy longer than those who come from non-HBCUs. This suggests that NROTC units at HBCUs can contribute substantially to the Navy's goal of six-percent black representation in the officer corps. The units

at HBCUs also provide valuable visibility for the Navy in the black community. According to Captain James Bowen, Commanding Officer of the NROTC Unit at Morehouse College, the presence of Naval officers in close proximity to college students allows them to be a vital asset to recruiters. The image of success in the Navy presented by NROTC staff officers can help attract quality black students into officer programs.

C. RECOMMENDATIONS

The results of this study support the following recommendations. First, because college resources tend to have a positive effect on officer performance measures, the Navy should try to direct its research grants and government contracts to NROTC schools and, when possible, to affiliated HBCUs.

Second, since attending an HBCU does not have a negative effect on promotion, but does have a positive effect on retention, the NROTC units at HBCUs should not be considered for closure on the basis of the performance of the officers commissioned there.

Finally, although not significant, black officers from HBCUs tend to have a lower probability of promotion than do those from a non-HBCUs. This can be attributed somewhat to the poor socialization of blacks from HBCUs into a predominantly White environment. The authors recommend further study specifically targeted at this issue.

APPENDIX A.

T-TEST RESULTS OF DIFFERENCES IN RESOURCES BETWEEN HBCU AND NON-HBCU

STUSHARE

	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM
NON-HBCU	0.20157396	0.10074907	0.00748862	0.07385882	0.55880623
HBCU	0.27159008	0.04716432	0.00292501	0.17032268	0.33150172

VARIANCES	T	DF	PROB > $|T|$
EQUAL	-9.7756	439.0	0.0001

FOR H0: VARIANCES ARE EQUAL, F'= 4.56 WITH 180 AND 259 DF   PROB > F'= 0.0001

ENDSHARE

	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM
NON-HBCU	0.02310090	0.03777249	0.00302422	0	0.39325009
HBCU	0.00450746	0.01391780	0.00092173	0	0.09989637

VARIANCES	T	DF	PROB > $|T|$
EQUAL	6.7926	382.0	0.0001

FOR H0: VARIANCES ARE EQUAL, F'= 7.37 WITH 155 AND 227 DF PROB > F'= 0.0001

GRANTFTE

	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM
NON-HBCU	2472.910387	3375.189371	250.8758502	79.9158090	22206.62899
HBCU	1813.836484	572.951687	35.5329552	956.7429089	5201.18315

VARIANCES	T	DF	PROB > $|T|$
EQUAL	3.0869	439.0	0.0022

FOR H0: VARIANCES ARE EQUAL, F'= 34.70 WITH 180 AND 259 DF   PROB > F'= .0001

TOTFTE

	MEAN	STD DEV	STD ERROR	MINIMUM	MAXIMUM
NON-HBCU	16706.24145	14642.21787	1088.347483	2086.419958	92930.37114
HBCU	9440.02446	4631.71338	287.246670	6552.334154	35512.92944

VARIANCES	T	DF	PROB > |T|
EQUAL	7.4851	439.0	0.0001

FOR H0: VARIANCES ARE EQUAL, F'= 9.99 WITH 180 AND 259 DF   PROB > F'= 0.0001

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